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(54) **Magnetic tape cassette**

(57) In a magnetic tape cassette the hub carrying the magnetic tape is braked to prevent the tape from slackening when the cassette is taken off a recorder. The hub is of double structure comprising an outer flangeless hub 12 carrying the magnetic tape and coupled to an inner hub 6 which is axially movalbe within the outer hub, the inner hub having a shaft portion 7 and a peripheral portion 10, the underside of which has radial gear teeth. In the dismounted condition of the cassette, the gear-toothed portion 10 is thrust into engagement with a gear-toothed part 5 of the cassette casing by spring 15, thereby applying a braking force to the outer hub 12 through the inner hub 6. When the cassette is positioned on a recorder, the inner hub 6 is moved within the outer hub by the drive shaft 8, against the bias of the spring 15, to disengage the two gear-toothed parts.

FIG.3

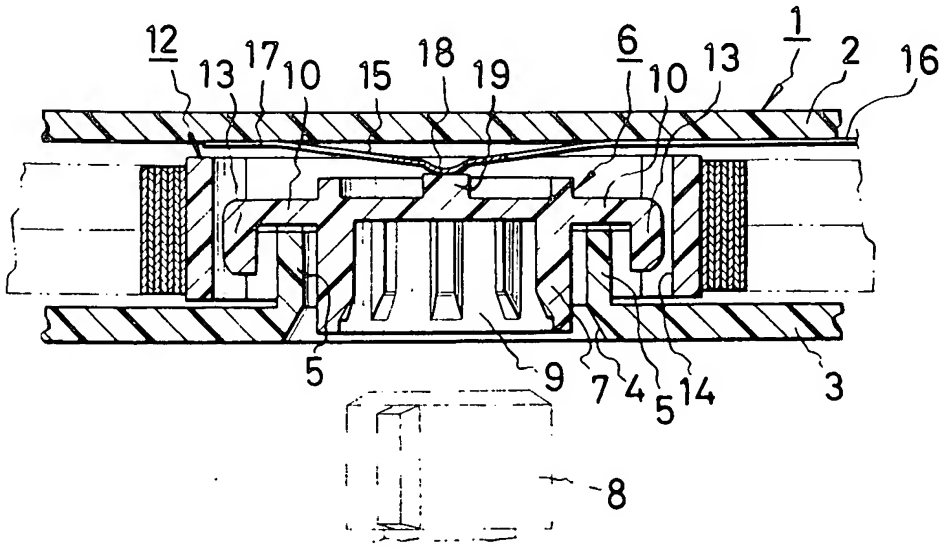

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FIG.1

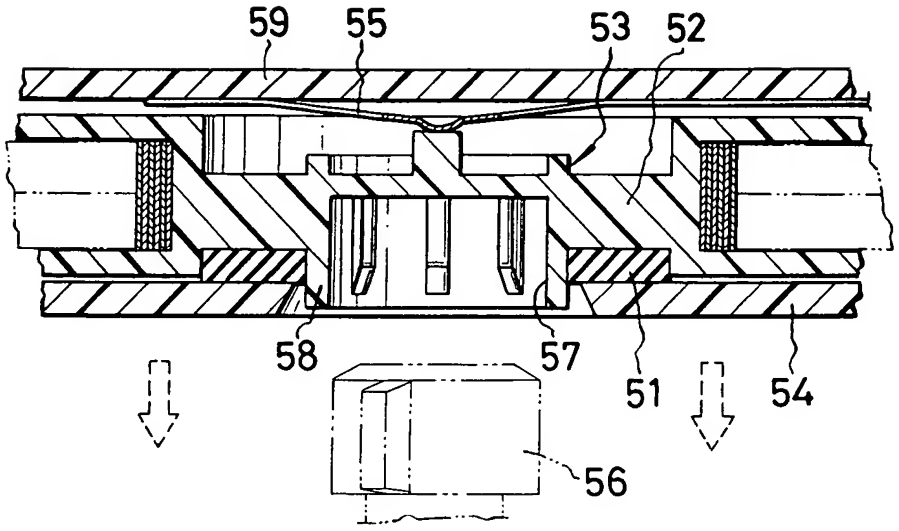

FIG.2

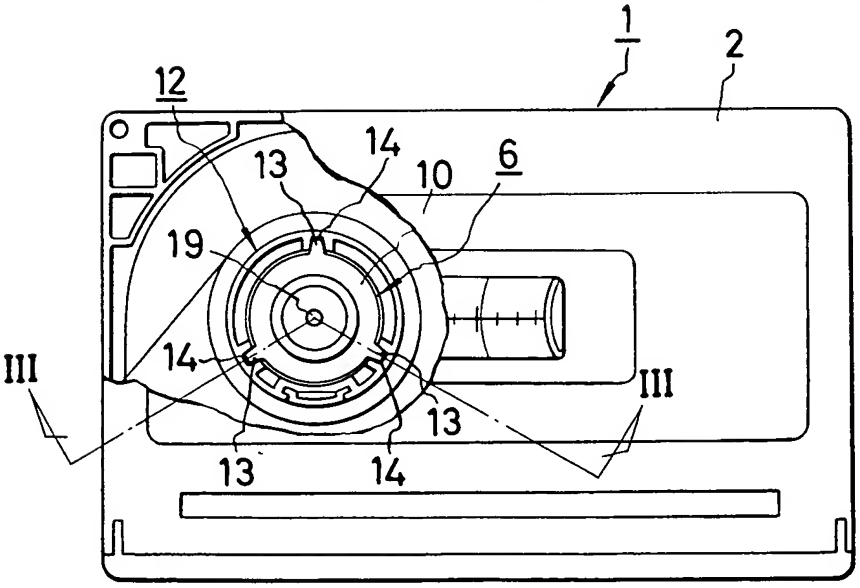

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FIG.3

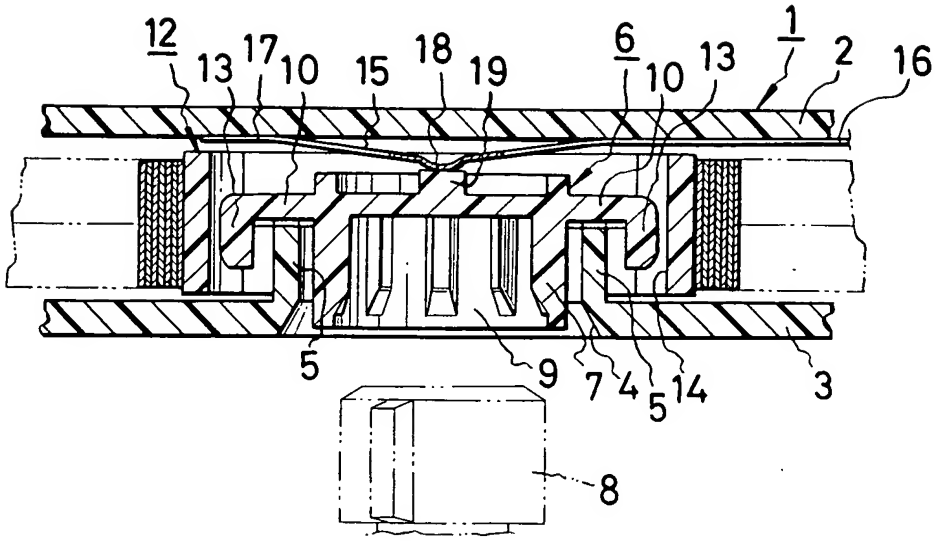

FIG.4

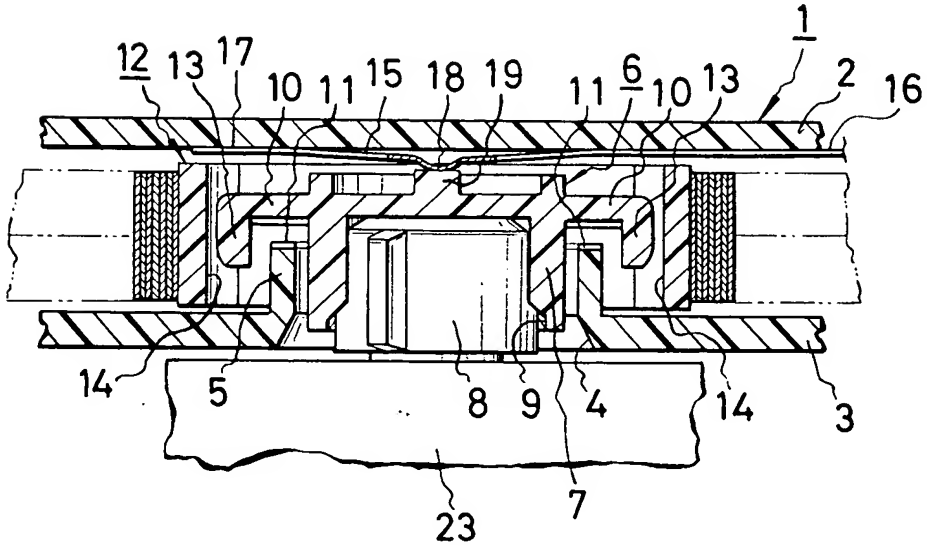

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FIG.5

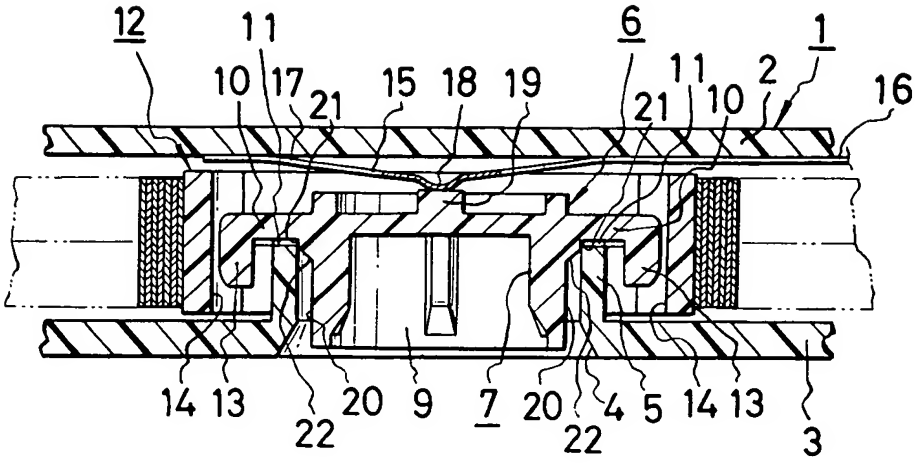
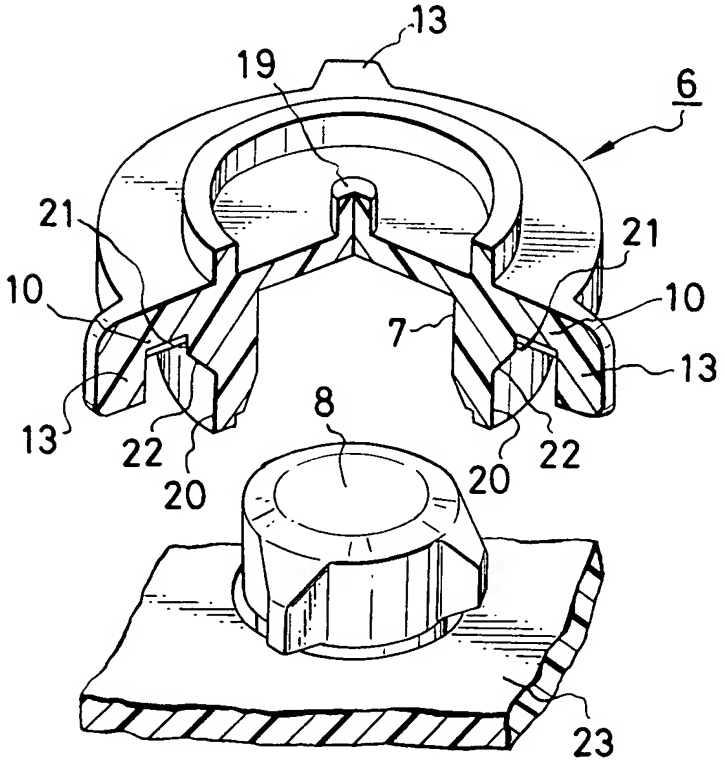


FIG.6



SPECIFICATION

Magnetic tape cassette

Background of the invention

1) *Field of the invention*

This invention relates to a magnetic tape cassette. More particularly, the invention relates to a novel magnetic tape cassette which is used for a video recorder or the like and is characterised in that the hub carrying the tape is braked and slack in the tape can be avoided when the cassette is taken off a recorder.

2) *Description of the prior art*

The hubs of conventional magnetic tape cassettes are generally provided with peripheral flanges to hold the magnetic tape wound thereon. Further, in order to avoid slack in the magnetic tape, some of them are provided with brake mechanisms to prevent movement of the hubs when the cassettes are not used. The brake mechanism, however, is not satisfactory in its effect, or is complicated in structure.

For example, there is a magnetic tape cassette in which a washer-like rubber brake plate is mounted to the underside of each hub and, when the cassette is dismounted from a reel base (hereinafter referred to as "dismounted condition"), the hub is pressed toward the side of a lower case by a leaf spring, thereby prohibiting the rotation of the hub. When the cassette is mounted to the reel base (hereinafter referred to as "mounted condition"), the hub is pressed upward by a hub drive shaft on the reel base so that the brake force acting on the hub is released.

In this case, the brake force acting on the hub depends on the frictional resistance between the brake plate and the inner surface of the lower case. For this reason, in the event that a shock is exerted on the cassette, the hub plays within the case resulting in loosening of the tape, and complete braking of the hub under the dismounted condition cannot be attained.

In another type of a conventional magnetic tape cassette having a brake mechanism, gear teeth are formed on the circumference of a peripheral flange of the hub and a ratchet mechanism is attached to the outer case. Under the dismounted condition, the gear teeth are brought into engagement with the ratchet mechanism to apply a brake force to the hub.

In this case, even though complete braking can be attained under the dismounted condition, the brake mechanism is complicated and the size of the magnetic tape cassette becomes large.

Brief summary of the invention

This invention is proposed in order to eliminate the above-described disadvantages in the conventional art.

It is, therefore, the primary object of the present invention to provide a magnetic tape cassette in which, under the dismounted condition, the hub is subjected to a reliable brake force and the magnetic tape can be prevented from slackening.

Another object of the present invention is to provide a magnetic tape cassette which is not complicated in structure and which can be made small in size.

A further object of the present invention is to provide a magnetic tape cassette which is easily produced and is durable under repeated and long-term use.

In accordance with the present invention, the magnetic tape cassette of the present invention has a pair of hubs held in halves of upper and lower cases, each of said hubs comprising an inner hub which engages with a drive shaft of a reel base and an outer hub which carries a magnetic tape wound thereon. Under the dismounted condition of the magnetic tape cassette, gear teeth formed in the inner hub come into engagement with gear teeth which are formed on a hub shaft fitting hole of the lower case, thereby prohibiting the rotation of the set of inner and outer hubs. Meanwhile, in the mounted condition, the engagement between the gear teeth of inner hub and those of the hub shaft fitting hole is cancelled and the brake force is released.

In accordance with another embodiment of the present invention, a cylindrical shaft part of the above-mentioned inner hub is provided with a front end part, a base side part and a connecting tapered part for connecting the two parts, and the outer diameter of the front end part is sufficiently smaller than the inner diameter of the fitting hole of the lower case and the outer diameter of the base side part is slightly smaller than the inner diameter of the above fitting hole, thereby aligning the gear teeth of the inner hub relative to those of the fitting hole of the lower case and facilitating the engagement of these gear teeth.

Brief description of the drawings

The nature, principle and details of the invention will be more clearly apparent from the following detailed description with respect to the preferred embodiments of the invention when taken in conjunction with the accompanying drawings, in which:

Figure 1 is a vertical cross-sectional view of the main part of a conventional magnetic tape cassette;

Figure 2 is a partially cutaway plan view of an embodiment of the present invention;

Figure 3 is a vertical cross-sectional view of the main part of the same embodiment taken along the line III-III of Figure 2, in which a hub is thrust toward the side of a lower case;

Figure 4 is also a vertical cross-sectional view of the same, in which the hub is thrust toward the side of an upper case;

Figure 5 is a vertical cross-sectional view of the main part of a second embodiment; and

Figure 6 is a perspective view of an inner hub which fits with a drive shaft on a reel base, said hub being cut away to show its cross section.

Detailed description of preferred embodiments

Referring now to the accompanying drawings, the magnetic tape cassettes of the present invention will be described in more detail. In the first place for reference purposes, the mechanism and functions of

a conventional magnetic tape cassette will be described.

In the magnetic tape cassette shown in Figure 1, a washer-like rubber brake plate 51 is mounted to the rear surface of an inner plane section 52 of a hub 53. The hub 53 is pressed toward the side of a lower case 54 by a leaf spring 55 under the dismounted condition. Therefore, the brake plate 51 is brought into contact with the inner surface of the lower case 54 so that the rotation of the hub 53 is prohibited. While under the mounted condition of the cassette, a drive shaft 56 of a reel base is fitted inside a drive shaft fitting hole 57 of a shaft part 58 of the hub 53, and the hub 53 is pressed upward toward the side of an upper case 59 so that the brake force acting on the hub 53 is released.

In the magnetic tape cassette of the present invention, the structure of the hub is quite different from that of the conventional ones. That is, the hub of the magnetic tape cassette of the invention is of double structure comprising an inner hub and an outer hub. The magnetic tape is wound around the outer hub and the inner hub has the functions of braking under the dismounted condition and brake-releasing under the mounted condition.

As shown in Figure 2, the external appearance of the magnetic tape cassette of the invention is almost the same as that of the conventional magnetic tape cassette. In the drawings, the reference numeral 1 denotes a magnetic tape cassette; 2, an upper case of the cassette; and 3, a lower case. A hub shaft fitting hole 4 is formed in the lower case 3. A cylindrical part 5 extends from the inner edge of the hub shaft fitting hole 4 toward the side of the upper case 2 so that the inner surface of the cylindrical part 5 defines the hub shaft fitting hole 4. An inner hub 6 is provided with a cylindrical shaft part 7 which is fitted inside the fitting hole 4. Under the mounted condition, a drive shaft 8 of a reel base 23 is inserted into a fitting hole 9 of the shaft part 7 (Figure 4). The underside of a brim part 10 of the inner hub 6 gear-toothed, and an end face 11 of the cylindrical part 5 of the lower case 3 toward the side of the upper case 2 is also gear-toothed correspondingly. An outer hub 12 is fitted outside the inner hub 6. These hubs engage with each other so that one may be axially thrustable within the other by projections 13 formed on the outside of the brim part 10 of the inner hub 6 and grooves 14 formed in the inner surface of the outer hub 12. Numeral 15 denotes a leaf spring, one end 16 of which is secured to the inner surface of the upper case 2 and the other end 17 of which is only in contact with the inner surface of the upper case 2. A vertex 18 of the leaf spring 15 extending in a mountain-like shape toward the side of the lower case 3 presses a projection 19 at the center of the upper surface of the inner hub 6, biasing the inner hub 6 toward the side of the lower case 3.

Under the dismounted condition of the magnetic tape cassette having the above-described construction, the inner hub 6 is thrust toward the lower case 3 by the force of the leaf spring 15. Therefore, the gear-toothed part formed on the underside of the brim part 10 of the inner hub 6 is brought into engagement with the gear-toothed part formed on the end face 11 of the cylindrical part 5 of the lower case 3, thereby applying a brake force to the inner hub 6 and the outer hub 12. In the mounted condition as shown in Figure 4, since the inner hub 6 is thrust toward the upper case 2 by the force of the drive shaft 8, the brake force on the inner hub 6 is released.

With the brake mechanism as described above, reliable brake action is applied to the hub of the magnetic tape cassette and the magnetic tape is prevented from slackening under the dismounted condition. Further, since the structure of the brake mechanism is simple and compact, the above-described hub can be mounted on a conventional cassette casing. Still further, a brake gear is not formed on a peripheral flange of the hub so that the peripheral flanges of the hub can be omitted. Therefore, the above brake mechanism of the invention will improve the function and reduce the size of magnetic tape cassettes.

Shown in Figure 5 is a modified embodiment of the magnetic tape cassette according to the present invention. In this embodiment, the axis of the cylindrical part 5 of the lower case 3 and the axis of the cylindrical shaft part 7 of the inner hub 6 are so aligned that the engagement of gear-toothed parts is made easier and more reliable.

The hub in this embodiment is also of double construction comprising an inner hub and an outer hub. The overall structure of the cassette itself is about the same as the foregoing first embodiment except for the following points.

The outside wall of the shaft part 7 of the inner hub 6 includes a front end part 20, a base side part 21, and a connecting tapered part 22 which connects these two parts. The front end part 20 has an outer diameter which is sufficiently smaller than the inner diameter of the fitting hole 4 and is positioned within the fitting hole 4 when the inner hub 6 is thrust toward the side of the upper case 2 under the mounted condition. The base side part 21 has an outer diameter which is slightly smaller than the inner diameter of the fitting hole 4 and is positioned within the fitting hole 4 when the inner hub 6 is thrust toward the side of the lower case 3 under the dismounted condition. The connecting tapered part 22 connecting these two parts 20 and 21 is of frustoconical shape. The shape of the tapered part 22 may suitably be curved or slightly tapered such that the outer diameter thereof gradually increases from the front end part 20 toward the base part 21.

In the magnetic tape cassette 1 of the present invention under the mounted condition, the inner hub 6 is thrust toward the side of the upper case 2 by the drive shaft 8 fitted inside the fitting hole 9 of the shaft part 7 of the inner hub 6, defining a predetermined clearance between the shaft part 7 and the fitting hole 4 of the lower case 3. On the other hand, when the cassette 1 is dismounted from the reel base 23 and the shaft part 7 of the inner hub 6 is then thrust toward the side of the lower case 3, the shaft part 7 is guided to the center of the fitting hole 4 by the connecting tapered part 22 so that the shaft part 7 is under the action of the brake force as located at

the center of the fitting hole 4.

According to the magnetic tape cassette as described above, the engagement between the gear-toothed parts becomes easier and more reliable so that the hub has no play even when vibrations or shocks are exerted on the cassette under the dismounted condition, and slackening of the magnetic tape can completely be avoided. Further, since the axis of the hub is well aligned with the axis of the hub shaft fitting hole under the braked dismounted condition, the center of the drive shaft on the reel base can be aligned with the shaft part of the hub when the magnetic tape cassette is mounted to the reel base, so that the mounting of the cassette becomes quite smooth.

Although the present invention has been described in connection with the preferred embodiments thereof, other variations and modifications will be apparent to those skilled in the art.

CLAIMS

1. A magnetic tape cassette comprising upper and lower cases, a pair of hubs rotatably held between said upper and lower cases, and a magnetic tape wound on said hubs, characterized in that each of said hubs comprises an outer hub having a cylindrical part which carries said magnetic tape wound thereon and an inner hub which is axially movably fitted within the cylindrical part of said outer hub; said inner hub is provided with a first gear-toothed part on the underside thereof, said lower case is provided with a second gear-toothed part on the upper side thereof; said inner hub transmits a drive force from a drive shaft on a reel base to said outer hub when said cassette is mounted on said reel base; and both said gear-toothed parts are brought into engagement when said cassette is dismounted from said reel base, thereby applying a brake force to said outer hub.

2. A magnetic tape cassette as claimed in Claim 1, wherein said outer hub comprises a flangeless type cylindrical body and said inner hub comprises a shaft part which engages with the drive shaft of said reel base, a brim part formed around said shaft part and projections which engage with said outer hub, said first gear-toothed part being formed on the underside of said brim part; and said lower case is provided with a hub shaft fitting hole to receive said shaft part, said second gear-toothed part being formed on the upper side of said hub shaft fitting hole.

3. A magnetic tape cassette as claimed in Claim 2, wherein the outside of said shaft part of the inner hub is provided with a front end part, a base side part, and a connecting tapered part for connecting said two parts, the outer diameter of said front end part being sufficiently smaller than the inner diameter of said hub shaft fitting hole of said lower case and the outer diameter of said base side part being slightly smaller than the inner diameter of said hub shaft fitting hole, thereby aligning the axis of said inner hub with the axis of said hub shaft fitting hole in a dismounted condition of said cassette.

4. A magnetic tape cassette constructed, arranged and adapted to operate substantially as described with reference to, and as shown in, Figures 2 to 4 or Figures 5 to 6 of the accompanying drawings.

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